








Improvements in or relating to alcohol detection devices

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Abstract of EP0147131

An alcohol detection device for controlling the ignition circuit of a vehicle. The device incorporates an alcohol sensor (10) within an open ended body (21) to enhance evaporation of condensation within the body (21). Also mounted in the body (21) is a breath pressure operative switch (25) to operate in conjunction with the sensor (10). The outputs from the sensor (10) and the switch (25) are fed to an electronic circuit latching means (19) controlling a short provided on a vehicle's ignition circuit. An intending driver exhales into the body (21) a sufficient amount to activate the pressure switch (25) and in so doing provide a breath sample for the sensor (10). A time delay circuit (16) is preferably provided whereby the pressure switch (25) must be closed for a time period commensurate to that of the timer (16) to provide an output signal to the latching means (19).

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(54) Improvements in or relating to alcohol detection devices.

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"Alcohol Detection Device".

This invention relates to an alcohol
detection device and in particular such a
device with associated electronic circuitry
to control the mode, operative or otherwise,
5 of an ignition circuit of a vehicle's prime
mover. The device is particularly intended
for use on automobiles or other road user
vehicles to prevent or at least limit use
of the vehicle by alcoholically intoxicated
10 drivers.

It is well established that numerous traffic accidents involve and in particular are caused by drivers intoxicated by alcohol. An object of this invention is to provide a device which will detect the presence or otherwise of alcohol and if "alcohol free" conditions are not present maintain an ignition circuit of a vehicle's prime mover inoperative. Within this specification the term "alcohol free" is used to conveniently describe conditions where there is complete absence of alcohol and also conditions where alcohol may be present but at a level below a level at which appropriate authorities have deemed as being the maximum permissible alcohol level for an operator of a vehicle. Again, while this level may vary from one place to another they are well established at least as regards road vehicles such as automobiles.

Various devices have been proposed to achieve the object of demobilizing a vehicle if the intending driver is

intoxicated and thus "alcohol free" conditions are not present. Various such devices are taught in US Patents 3,855,573 3,815,087 3,824,538 3,823,382 and other US Patents recorded as references in one or more of the above
5 US Patents. In addition there is Australian Letters Patent No. 516365. A limitation that arises from such known devices is the inconvenience that can result in using a vehicle equipped therewith and accordingly, as a matter of choice, tend to be unacceptable. The inconvenience
10 and/or unacceptability arises not only from the integrity of the device in fulfilling its role but also from the necessity of having to use the device at times when there is no likelihood of an intending driver being intoxicated. As a general rule such conditions prevail
15 for a substantial period of time during which a vehicle is likely to be used. A further object of this invention is to provide a device which will overcome this problem or at least reduce it to a level so as to render the device acceptable or at least not particularly inconvenient to
20 use.

Further problems arise with known devices as regards their sensitivity or lack of sensitivity. In the former case the presence of alcohol in the ambient air can render a device susceptible to spurious operation. On the other
25 hand if a device is lacking in sensitivity considerable exhalation may be required from an intending user before

the device has sufficient input to make the selection required of it. The device of Australian Patent 516365 has attempted to overcome this problem by providing that the alcohol sensor thereof is normally isolated from the ambient air. An air pressure operated sealing unit must be activated by a user's exhalation before the sensor is exposed to a breath sample.

Such an approach can lead to another problem associated with known devices being that of condensation and more particularly the desirability of achieving ready evaporation of condensation. Residual condensation can result in a false reading and/or delay while sufficient evaporation takes place to revert to a normal stable state.

Further, as a general rule, available alcohol sensors are susceptible to change resulting from change in ambient temperature and/or ambient humidity. This can render the threshold point associated with the sensor in determining "alcohol free" breath or otherwise inconsistent and thus the reliability of the device can be called into question.

A further object of this invention is to limit the problems associated with humidity and temperature whether they be those arising from instant use and/or from ambient conditions.

According to a first broad aspect of the invention there is provided an alcohol detection device comprising an open ended body defining an interior chamber with one end of the body forming an inlet and the other end forming an outlet, an alcohol sensor having an electrically compatible output mounted in the interior chamber of the body and a fluid pressure operative switch mounted in a section of the chamber between the inlet and the sensor as will operate at a pre-selected fluid pressure within that section of the chamber.

According to a second broad aspect of this invention there is provided a vehicle ignition control circuit comprising an alcohol detection device having an open ended body with one end forming an inlet and the other end forming an outlet, an alcohol sensor having an electrically compatible output mounted partway along the interior chamber of the body and a fluid pressure operative switch mounted in the chamber between the inlet and the sensor as will operate at a pre-selected fluid pressure in that part of the chamber, the output of the sensor and the switch being connected to a pair of comparators having a common output thereof connected to ignition circuit latching means whereby if the sensor detects alcohol the output of the comparators will not provide an operating signal to the latching means as to clear an ignition circuit controlled thereby.

In further describing the invention reference is made to the accompanying drawings wherein;

- Figure 1. is a cross-sectional view of the device without adjunct circuitry, and
- 5 Figure 2. is a combination circuit/block diagram of the circuitry..

An alcohol detection device comprises a body 21 preferably formed from moulded plastic components. Body 21 is of an open ended configuration having an inlet 22 and an outlet 10 23 at opposing ends to thus assist fluid flow therethrough. Inlet 22 is preferably in the form of a mouth-piece standing proud of an outer casing 30 of the device to thus facilitate a user exhaling into an interior chamber 24 between inlet 22 and outlet 23. Mounted within the 15 interior chamber 24 is an alcohol sensor 10 which is preferably in the form of an electronic semiconductor device which incorporates a heater 32. Sensor 10 preferably has an annular shaped outer body 10^a with sensor head 10^b suspended in the interior thereof. The 20 sensor 10 is mounted substantially axially common with the longitudinal axis of chamber 24 such that the head 10^b of sensor 10 is disposed clear of the surrounding body 21. This exposed mounting of the head 10^b facilitates air circulation through the chamber 24 and thus evaporation of 25 any condensation formed on the interior wall of the body.

21. The incorporation of the sensor 10 within the circuitry is described in more detail hereinafter.

The volumetric fluid flow capacity of the chamber 24 is larger at the inlet 22 than at the sensor 10 and/or
5 thereafter to the outlet 23. The object of providing this restrictive configuration is to provide that with a reasonable pronounced exhalation of breath at the inlet 22 a back pressure will result within that section of the interior chamber 24 between the sensor 10 and the inlet 22.
10 This back pressure is utilised to operate a pressure sensitive switch 25 as more particularly described hereinafter.

Preferably the body 21 is formed of two components 21^a and 21^b each of a generally cylindrical configuration.

15 Component 21^b has an inner end section 21^c adapted to fit to the associated end of component 21^a and in so doing enable the mounting of sensor 10 within the interior chamber 24 in the region of the junction between the two components of the body 21. Preferably component 21^b
20 substantially reduces in diameter adjacent to the junction with component 21^a and thereafter forms the outlet 23 of the chamber 24 in the form of a small diameter bore. This reduced size of outlet 23 together with the volumetric reduction provided by the annular shape of sensor 10
25 provides the desired restriction. It is envisaged that

the restriction provided by the sensor 10 alone would be sufficient. By also providing that outlet 23 is of a smaller diameter reduces the surface area of the wall defining chamber 24 and thus reduces the surface on which
5 condensation can form.

As aforesaid a pressure sensitive switch 25 is provided to be operated by back pressure in the associated section of the chamber 24. The purpose of this is to ensure that sufficient volume of exhalation breath is provided for the
10 sensor 10 to make the measurement required of it. Unless sufficient back pressure is created in the chamber 24 switch 25 will not be operated to activate the adjunct circuitry.

As more particularly described hereinafter the circuitry
15 also provides that switch 25 must not only be operated but also must be maintained closed for a minimum pre-determined period of time before the circuitry will provide an adequate operating signal.

Preferably switch 25 is mounted into the interior chamber
20 24 between inlet 22 and sensor 10 by way of an antechamber 26. A diaphragm 27 is retained by the body 21 to sealingly separate switch 25 from the interior chamber 24 and its associated antechamber 26. Diaphragm 27 thus effectively forms part of the wall defining the interior chamber 24

and will be deflected outwardly thereof with increasing pressure therewithin. Diaphragm 27 is connected to switch 25 such as by cap 41 such that deflection of diaphragm 27 depresses switch 25.

5 To restrict or at least limit physical tampering with switch 25 preferably antechamber 26 is conjoined to chamber 24 by a port 28. Port 28 is dimensioned and positioned to restrict physical access via the interior chamber 24 and the antechamber 26 to diaphragm 27. In
10 addition a suitable grid or mesh element 29 could be mounted in port 28 or otherwise between diaphragm 27 and inlet 22.

Preferably outer casing 30 is provided about body 21 to provide for further physical protection of the sensor 10
15 and switch 25. Casing 30 also enables fixed or detachable mounting insitu and insulates the body 21 from surrounding ambient air conditions to help stabilise the condition in which the sensor 10 operates.

Referring in particular to Figure 2, the primary purpose of
20 the device and its adjunct circuitry is to control an ignition circuit of a road vehicle. In Figure 2 ignition key switch 3 and distributor points 4 represent a conventional ignition circuit of such a vehicle. In installing the device the points 4 are shorted to earth.

The circuitry is preferably powered from the automobile's battery represented by terminals 1 and 2. Preferably the circuitry incorporates a conventional stabilised power supply network comprising a voltage regulator 5 and associated protective components being diode 6, fuse 7, over voltage protection zener diode 8 and stabilising and filtering capacitors 9. The coupling of the power supply circuit to the automobile's battery provides for a permanent supply to the circuit which is thus continuously alive.

Sensor 10 together with resistor 42 forms part of a resistive divider chain 31. Preferably a thermistor 43 and heater 32 are provided to facilitate stable and compensating temperature conditions. Sensor 10 and switch 25 have outputs to comparators 14 and 15 respectively. Preferably an inverting medium gain amplifier 13 is provided as an intermediate stage between sensor 10 and comparator 14. Comparators 14 and 15 are preferably arranged in an OR configuration with each comparator having one input thereto pre-set at a reference level. Reference voltage levels are provided to both comparators 14, 15.

Preferably the output of comparators 14 and 15 provide a first input to a third comparator 17 forming an input stage to ignition circuit latching means 19.

Preferably, the arrangement is such that the latching means when set removes the short provided on the points 4. The remaining input to comparator 17 is provided by a timer 16 of conventional programable structure. Timer 16 is
5 programmed so that during a pre-determined time period or periods comparator 17 provides an operating signal to the latching means 19 regardless of the level of the other input to comparator 17. Thus, the timer 16 can be programmed to maintain the latching state provided by the
10 circuitry during those periods. It is envisaged that this facility will be utilised during those hours when there is a minimum likelihood of use of a vehicle being made by an intoxicated driver.

The output of comparator 17, or if the comparator 17 and
15 the associated timer 16 are not provided, the common output of comparators 14 and 15 is connected to latching means 19 controlling the ignition circuit represented by switch 3 and distributor points 4. The latching means preferably comprises a SCR 19^a in series with a coil 19^b of a relay
20 controlled contact wired to form the short of the distributor points 4 to earth. To reset the latching means an operating signal must be provided to the gate of SCR 19^a to trigger the SCR and thus energise coil 19^b. Preferably a LED 20 is provided to indicate that latching
25 means 19 is set.

Preferably a time delay network 18 of the conventional resistive capacitor configuration is provided at the input to latching means 19. Thus an operating signal must be maintained for a period determined by the time constant of that delay network to obtain an effective operating signal to latching means 19. This ensures that not only must pressure switch 25 be operated by the exhalation pressure of a user but also switch 25 must be maintained closed for sufficient time for the capacitor of network 18 to adequately charge. Thus in using the device exhalation must not only be of adequate pressure but also for an adequate period of time for the circuitry to operate. This time delay also has the benefit that the effective measurement taken by the sensor is also after a period commensurate with the time constant of the delay circuit. This sampling delay helps provide more consistent readings as breath is essentially constant as to humidity and temperature. The sensor 10 thus tends to make the effective reading in correspondingly stabilised conditions.

CLAIMS:

1. An alcohol detection device comprising an open ended body (21) defining an interior chamber (24) with one end of the body (21) forming an inlet (22) and the other end
5 forming an outlet (23), an alcohol sensor (10) having an electrically compatible output mounted in the interior chamber (24) of the body (21) and a fluid pressure operative switch (25) mounted in a section of the interior chamber (24) between the inlet (22) and the sensor (10) as
10 will operate at a pre-selected fluid pressure within that section of the chamber (24), the volumetric fluid flow capacity of at least a zone of the cross-section of the interior chamber (24) from the sensor (10) to the outlet (23) inclusive being restricted relative to the minimum
15 cross-sectional volumetric fluid flow capacity of the interior chamber (24) between the sensor (10) and the inlet (22).
2. An alcohol detection device as claimed in Claim 1 wherein the body (21) defines an antechamber (26) with a
20 diaphragm (27) sealing the interior chamber (24) from the antechamber (26), a mechanical switch being disposed within the antechamber (26) and operatively associated with the diaphragm (27) to form the pressure operative switch (25).
3. An alcohol detection device as claimed in Claim 1 or
25 Claim 2 wherein the sensor (10) is of an annular shape

incorporating a sensor head (10^b) suspended within the interior of the sensor (10), the sensor (10) being mounted substantially axially common with the longitudinal axis of the interior chamber (24), the section of the interior chamber (24) between the sensor (10) and the outlet (23) is substantially reduced in size relative to the remainder of the interior chamber (24), the inlet (22) to the body (21) is formed as a mouth-piece and the body (21) is mounted in an outer casing (30) with the mouth-piece standing proud of the casing (30).

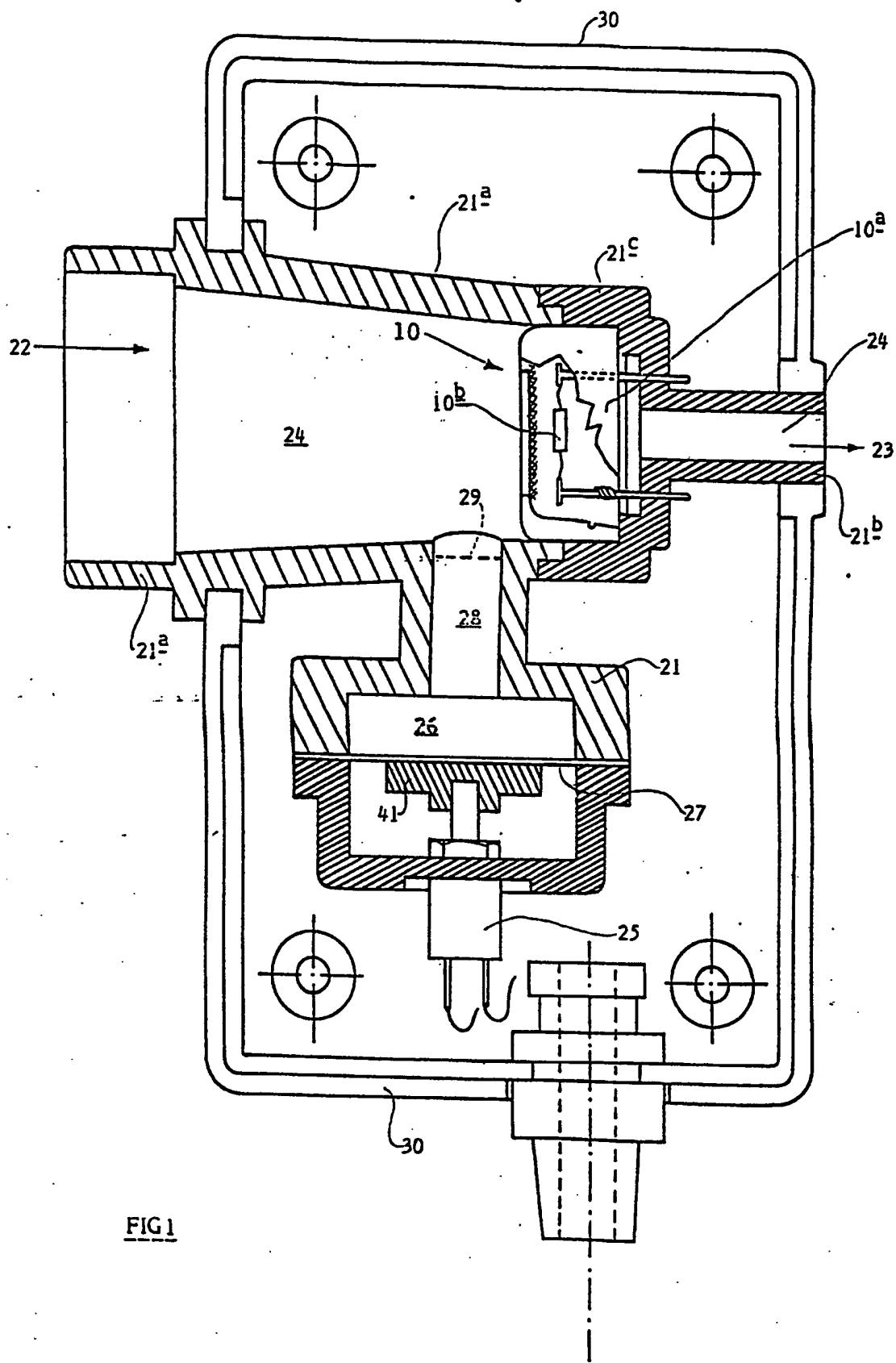
4. A vehicle ignition control circuit comprising an alcohol detection device having an open ended body (21) with one end forming an inlet (22) and the other end forming an outlet (23), an alcohol sensor (10) having an electrically compatible output mounted partway along the interior chamber (24) of the body (21) and a fluid pressure operative switch (25) mounted in the interior chamber (24) between the inlet (22) and the sensor (10) as will operate at a pre-selected fluid pressure in that part of the interior chamber (24), the output of the sensor (10) and the switch (25) being connected to a pair of comparators (14, 15) having a common output thereof connected to ignition circuit latching means (19) whereby if the sensor (10) detects alcohol the output of the comparators (14, 15) will not provide an operative signal to the latching means (19) as to clear an ignition circuit (3, 4) controlled thereby.

5. A vehicle ignition control circuit as claimed in Claim 4 wherein a time delay circuit (16) is incorporated at the input to the latching means (19) necessitating that to provide an operating signal thereto the pressure switch (25) must be closed for at least a time period commensurate with the time constant of the time delay circuit (16).

6. A vehicle ignition control circuit as claimed in Claim 5 wherein a timer is incorporated into the circuit (16), an output of the timer and the common output of the comparators (14, 15) being connected as inputs to a third comparator (17) forming an input stage to the ignition circuit latching means (19) whereby a time determined output of the timer will create a circuit operating state whereby the third comparator (17) will maintain an operating signal to the latching means (19), the latching means (19) comprises an SCR (19^a) in series with a coil (19^a) of a relay with the gate of the SCR (19^a) being connected to receive the operating signal.

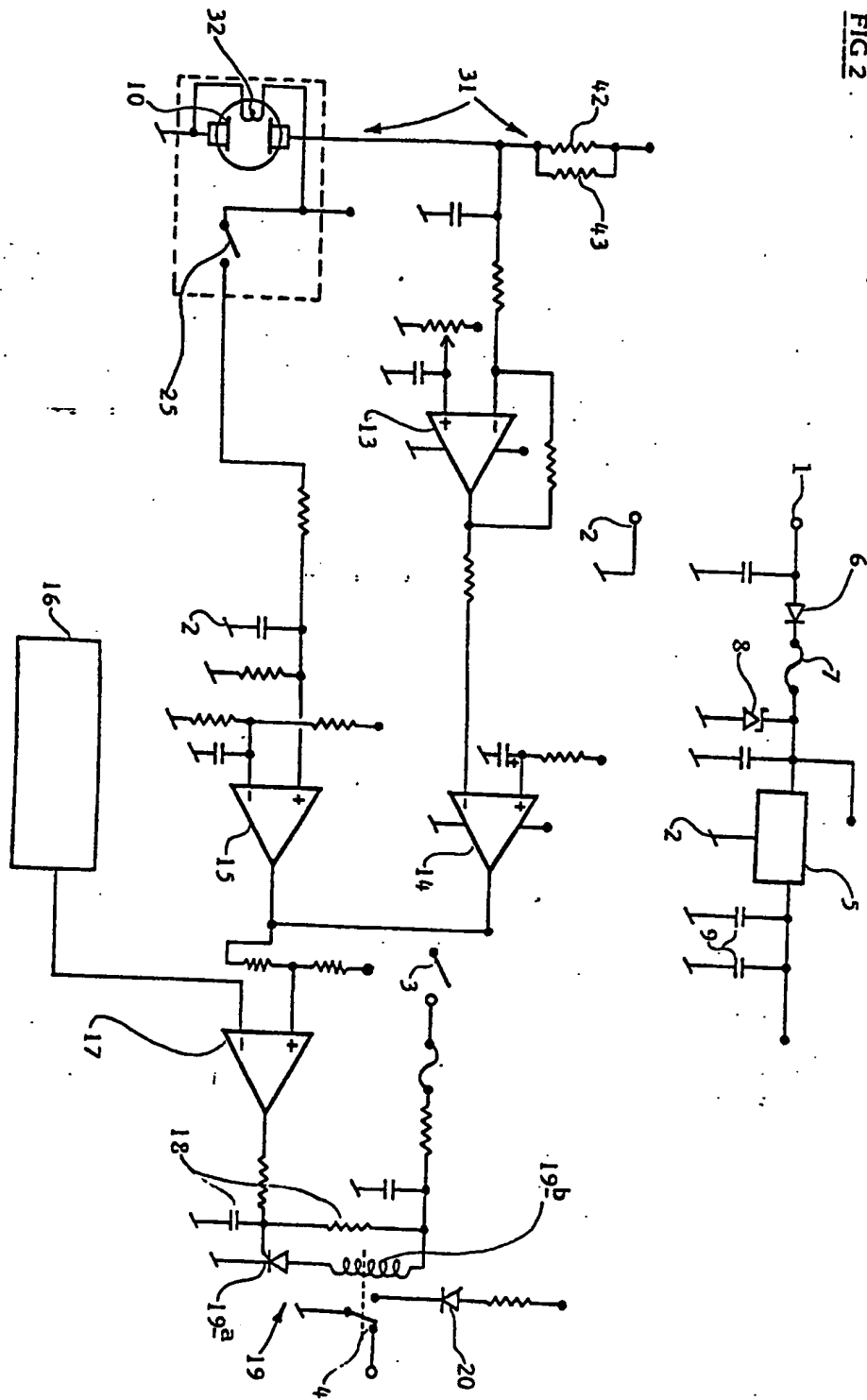
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FIG 2



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